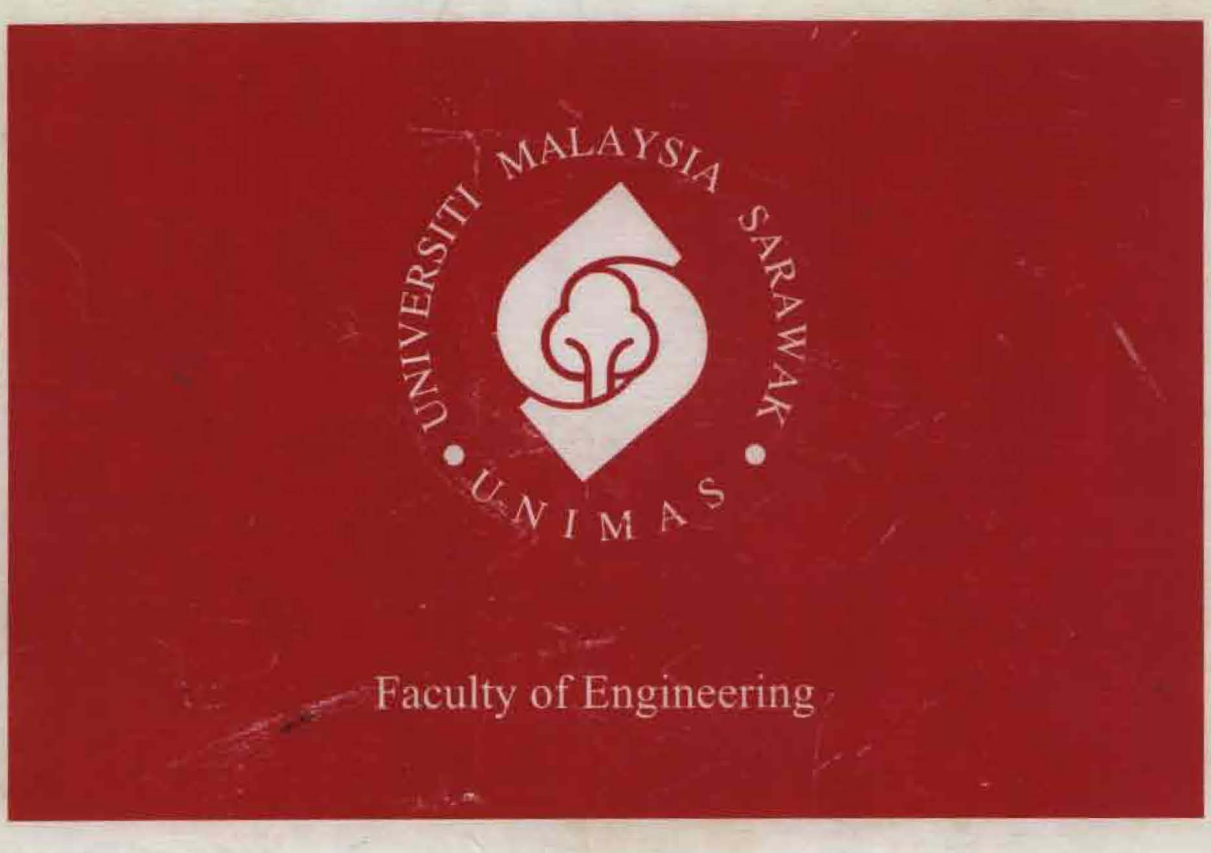

SOFTWARE INTERFACE FOR MICRO HYDRO SENSORS INTERFACING

Khoo Terh Sheng

Bachelor of Engineering with Honours
(Electronic and Computer Engineering)
2012

UNIVERSITI MALAYSIA SARAWAK

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SOFTWARE INTERFACE FOR MICRO HYDRO SENSORS INTERFACING

KHOO TERH SHENG

This project is submitted in partial fulfilment of

The requirements for the degree of Bachelor of Engineering with Honours

(Electronic & Computer Engineering)

Faculty of Engineering

UNIVERSITI MALAYSIA SARAWAK

2012

Dedicated to my family, friends and beloved one

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ABSTRAK

Perisian aplikasi untuk sistem mikro hidro dengan pengesan pengantaramuka merupakan satu projek yang boleh membantu untuk menyelia sistem hidro daripada jarak jauh. Sitem mikro hidro terdiri daripada beberapa bahagian yang sangat penting dan perlu dipantau supaya ia tidak mencapai keadaan yang kritikal sehingga mampu merosakkan motor mikro hidro. Selain itu, kuasa yang dihasilkan daripada mikro hidro adalah dalam prestasi yang optimum. Pembolehubah-pembolehubah yang perlu dipantau adalah seperti suhu voltan arus, kuasa, dan revolusi per minit (RPM). Projek ini dibahagikan kepada dua bahagian iaitu pengantaramuka pengesan dan perisian aplikasi. Perisian aplikasi adalah projek utama manakala pengantaramuka pengesan akan dijalankan oleh rakan saya. Dalam perisian aplikasi, fungsi utama adalah untuk memantau pengesan-pengesan dan juga menyimpan maklumat yang dipantau itu ke dalam pangkalan maklumat untuk rujukan masa hadapan. Selain daripada itu, perisian aplikasi juga mampu untuk menjana carta bagi setiap pembolehubah daripada pangkalan data yang telah dihasilkan. Carta dignakan untuk merumuskan prestasi mikro hidro. Perhubungan tanpa wayar digunakan untuk menyambungkan litar pengesan dengan komputer. Oleh itu sistem ini sesuai digunakan di kawasan luar bandar. Juruteknik juga mampu memantau mikro hidro tanpa perlu pergi ke tapak mikro hidro tersebut.

ABSTRACT

Software application for micro hydro sensors interfacing is a project that can aid in remote supervision of the micro hydro system. Micro hydro system consists of several parts that are very crucial and need to be monitored so that it can run in optimum performance. Those variables that need to be monitor are temperature, voltage, current, power, and revolution per minute (RPM). This project is divided into two sections, which are sensors interfacing and software application. Software application is the main topic for this project while sensors interfacing are done by my partner. In software application, it main function are to monitor sensors value and also logging the value into database for future reference. Other than that, it also able to generate graph for each variable after there are data in the database. Graph are use to summarize the performance in period of time while monitoring is for several seconds and preventing any damaged to micro hydro if, there are increasing till critical value for the variables. To retrieve data from sensors interfacing circuit, XBee wireless is used. This will allow software application requesting sensors information without needed physical wire. In addition, it is suit to be use in rural area which a physical wire is not suitable. Finally, technician work to monitor micro hydro can just sit at the monitor room and observing sensors information from software interface. This will prevent from going to micro hydro site every time to measure the variable mention above.

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LIST OF ACRONYMS

Term	Meaning
GUI	Graphical User Interface
PC	Personal Computer
AC	Alternating Current
USB	Universal Serial Bus
RPM	Revolution Per Minute
FYP	Final Year Project
LED	Light Emitting Diode
IDE	Integrated Development Environment
PIC	Programmable Integrated Circuit
ADC	Analog-Digital-Converter
HID	Human Interface Device
CDC	Communication Device Class
DOS	Disk Operating System
SQL	Structure Query Language
IC	Integrated Circuit
DC	Direct Current
TX	Transmit
RX	Receive
PAN	Personal Area Network

CHAPTER 1

INTRODUCTION

1.1 Background

Project discussed in this report should cover all the Software Interface for Micro Hydro Sensors Interfacing which is Graphical User Interface (GUI) installed on the Notebook or Personal Computer (PC) that assigned to connect with the micro hydro system. This micro hydro system is separated into four parts and each part is done by one student. The parts consists of controlling water flow, controlling current using dump load, sensors to detect system variables, and the GUI that control, logging, and showing the variables current values. To make it as a complete project, all parts need to be combined and become a micro hydro system with sensors interfacing and software interface.

Micro hydro power remains the most important of the renewable energy for electrical power production worldwide, it's providing 19% of the planet's electricity. In small scale hydro, it is installed and run if on the river, with no damp or water storage. This small scale hydro is one of the most cost-effective and environmentally energy technology to be considered for rural area or in less developed state to generating electricity.

Micro hydro system used generator as its core to generate alternating current (AC) high voltage to supply to the nearest village and power up many houses with basic electrical instrument in house such as lamp, television, radio, etc. Generator is a powerful electrical device that is used widely in damp system. Generator can be use for various applications depending on the user needs and configuration. Micro hydro system has many attribute to be monitored to ensure it is running smoothly and produce optimum performance.

Software interface for micro hydro sensors interfacing is a convenient application. It can assist in improving output of the micro hydro system, controlling other external devices, and showing real-time monitoring. Monitoring can be done through a centralized remote control device remotely. The attributes that this application monitored includes remote monitoring temperature of the micro hydro generator, voltage produced, current produced, current usage, power produced, power usage, and cycle of the AC voltage. Through remote monitoring, reduction of time needed for the technician going to the site is shorten because the technician can monitor the micro hydro system condition and can be alert in real time if there anything happen to the micro hydro system.

1.2 Project Overview

The project on Software interface for micro hydro sensors interfacing is involved in software part and need to be combined with my partner project that is Sensors Interfacing for Micro Hydro System. Sensors interfacing are involved to hardware part. This project focusing on the software part which is retrieval data from

the input sensors and then the input signal will be process by microcontroller and lastly are shown in the computer. For simulation hardware part and synchronize with software interface, temperature sensors LM35 is use with the Arduino Uno Rev3 board which will be the central processing for the sensors. Interfacing software will be written in Microsoft Visual Basic 2010 programming language to connect between Arduino Uno Rev3 and computer. The connections from main board to computer will use Universal Serial Bus (USB). Software will include a user-friendly Graphical User Interface (GUI).

Detection of the temperature, voltage, current, power, and cycle of the micro hydro system will be accomplished by using the suitable sensors and then connected to the Arduino Uno Rev3, and then the serial data will be transmitted over by using USB cable to a computer which is the connection between Arduino Uno Rev3 and computer. Basically, this project displays all the critical variable values discuss before from the micro hydro generator to the computer interface. After completion on the USB transmission, the project will be upgrade to wireless communication transmission by using XBee S2. XBee S2 will replace USB and only one Arduino Uno Rev3 is used instead of planned before using two Arduino Uno Rev3.

A Graphical User Interface (GUI) written in Microsoft Visual Basic 2010 will give users an authority to monitor the status of the micro hydro system, get, and alarm for critical event as well as controlling some of the external device. Below is the brief block diagram for the Software interface for micro hydro sensors interfacing.

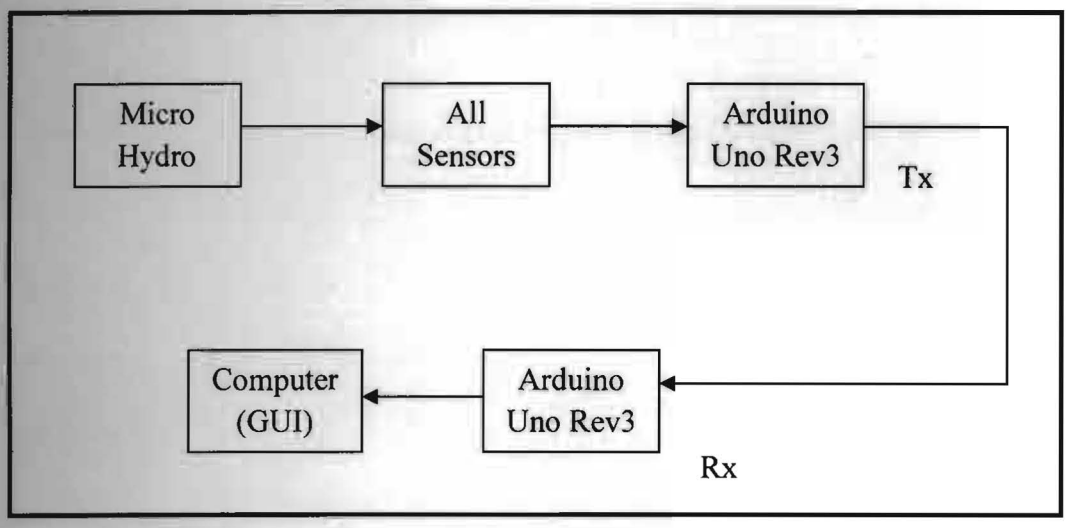

Figure 1.1: Block Diagram of the Project Overview

All sensors will keep monitoring the micro hydro variables, and then will be process by Arduino Uno Rev3 Tx. Serial data then will be transmitted over the air using wireless communication. After that, Arduino Uno Rev3 Rx will receive the serial data and keep the data in memory until the GUI request the serial data to be read. The benefit using serial port for this project is because of serial communication can cover a longer distance when compare to parallel port. A parallel port transmits and received data eight bits in a time over eight different wires. Although parallel communication is faster than serial communication because parallel communication can transfer data simultaneously, more wires needed and the cost will be higher than serial transmission cost. For a wireless communication, there will be using the low cost wireless communication that is compatible with Arduino Uno Rev3 main board. It is needed to install and configure separately for both devices.

1.3 Advantages and Disadvantages

With this software interface for micro hydro sensors interfacing, the energy produced can archive optimum range because of able to monitoring all factors. The energy will also readily predictable by looking on the logging database and graph plotting. In addition, the power produced by the micro hydro system is continuously as long there are water runs the turbine, system need to be able to divert the load if the power generated is too high. This system is a low cost system which is more convenience than using other renewable energy such as wind and solar power. Micro hydro will also last longer because of the turbine that runs is really protected well by the designed software interface with sensors interfacing. In addition, by having the data logged on database will give option for the technician to plot graph or view the previous log for analysis and diagnose the micro hydro system.

The drawback for this software interface for micro hydro sensors interfacing is it cannot store charges or power to be use when emergency such as the water level running very low and cannot run the turbine. It only will draw the power if overload which is very wasteful in term of power management efficiency. Other than that, this system cannot predict when the micro hydro will stop to work and need for some maintenance. The database for the remote data logger also hard to design because, such complicated database design will lead to complicated GUI design too. More on that, database is very wide topic. There are many method and software can be use to build simple database.

1.4 Objectives

The main objective of this project is to design and build a system in order to monitor and control the generator variables remotely:

i. To design the interfacing program to access the Arduino Uno Rev3 main board through Universal Serial Bus (USB).

ii. To design the Graphical User Interface (GUI) to access and retrieve serial data from Arduino Uno Rev3.

iii. To design GUI that capable on showing, alerting, logging, and plot graph in real-time and also for references.

iv. To study and analyze serial data transmission through USB using Arduino Uno Rev3.

v. To examine the integration between software and hardware in serial transmission.

vi. To build a wireless communication between Arduino Uno Rev3 Tx and Arduino Uno Rev3 Rx.

1.5 Problem Statements

In this project, there are several problems that are faced:

i. Communication range between hardware and computer is limited and not more than 50 meters.

ii. Deal with high voltage, high current and high power, circuitry need to be able to withstand these various input.

iii. Precision of detecting the voltage current, power, and temperature.

iv. Choosing the right database method for logging variables data.

v. Choosing the right software to write GUI for the software interface for micro hydro sensors interfacing.

vi. Choosing the right main board to suit the application which needs USB and wireless communication involved.

1.6 Project Scope

This scope of this project is to build a software application for micro hydro sensors interfacing for the retrieval circuitry. The software application for micro hydro sensors interfacing is software which runs on any windows based computer. The software will display various variable from the sensors interfacing such as temperature, current, power, voltage, frequency, speed (Km/Hour), and revolution per minute (RPM). It also will produce alarm if any of the variables reach critical threshold program by programmer. Other than that, real-time graph can be view too for temperature, current, power, and voltage. While other indicator will show as a bar chart such as are temperature, current, power, and voltage. Database can be open by anyone by using the suitable software that supports the database format. Only offline database is implement in this project due to the reason of rural area will not have any data connectivity.